Social Capital, High-Risk Sexual Behaviors, and Sexually Transmitted Infections in Agricultural Plantation Residents in Tanzania

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Abstract

Human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs) are leading causes of mortality and morbidity in many countries of the world. The practice of having concurrent sexual partners is an important risk factor for STI transmission. Social capital is a target area for improving sexual health. Social capital describes the ways in which individuals are connected to resources that can influence their behaviors, and provides methods of coping with stressors. Previous studies have yielded contradicting findings about the effects social capital has on sexual health behaviors and STI prevalence. Our study aims to investigate social factors, namely social capital and support, which may play a role in reducing STI prevalence and the practice of concurrent partnerships. We conducted secondary data analysis from a study of 623 agricultural plantation residents in Tanzania to assess this relationship, hypothesizing that higher social capital would be associated with less concurrent sexual partnerships and less prevalent STIs (including HIV, HSV-2, and syphilis). We used principal component analysis to convert seven variables related to social capital into a smaller set of uncorrelated factors. The resultant 3 factors – reciprocity, trust, and decision-making – were used as predictors in multiple regression models for both concurrent sexual partnerships and prevalent STI, stratified by gender. We found that having positive social capital in the 'network' dimension was associated with being less likely to have concurrent sexual partnerships among women (AOR=0.47, 95% CI 0.23-0.87) and that having positive social capital in decision making was associated with being *more* likely to have a prevalent STI among men (AOR=2.13, 95% CI 1.02-4.52). Transactional sex was significantly associated with both outcomes in women. Suggested initiatives for improvement of sexual health include creating community groups that encourage unity and fellowship among women in order to decrease the prevalence of risky sexual behaviors. More research is necessary to create a uniform definition of social capital that can be applied in future studies that examine the relationship between this concept and sexual health.

Social Capital, High-Risk Sexual Behaviors, and Sexually Transmitted Infections in Agricultural Plantation Residents in Tanzania

Human immunodeficiency virus (HIV), along with the associated acquired immune deficiency syndrome (AIDS), and other sexually transmitted infections (STIs) are leading causes of mortality and morbidity in many areas of the world. STIs such as syphilis and herpes simplex virus type 2 (HSV-2) cause not only acute illness, but can also cause long-term disability, damage to the reproductive and central nervous system, and even death if left untreated (World Health Organization, 2012). These types of infections are especially common in developing countries, where knowledge about the diseases and preventative measures, along with treatment methods, are inequitably distributed (Caetano et al., 2010; Norbu, Mukhia, & Tshokey, 2013; Oyekale, 2014). In sub-Saharan Africa, where syphilis prevalence was about 4% in 2008 (World Health Organization, 2012), for example, over 20% of perinatal deaths can be attributed to syphilis infection (Hossain, Broutet, & Hawkes, 2007). Of the estimated 498.9 million new cases of curable STIs worldwide in 2008, 92.6 million occurred in Africa alone (World Health Organization, 2012). STIs, especially ulcer-causing diseases such as HSV-2, can serve as HIV infection risk factors themselves (Tobian et al., 2009; Ward & Rönn, 2010; Kalichman, Pellowski, & Turner, 2011).

Incidence rates and rates of deaths attributed to HIV in particular have seen great reductions worldwide in recent years due to increased awareness, control and prevention measures, and improved access to treatment. However, according to the World Health Organization (2010), nations such as Tanzania, are still greatly burdened by the disease: 6.2% of Tanzanians between 15-49 years old were reportedly living with HIV in 2007. This epidemic continues to be a major public health crisis, affecting not only initially infected individuals, but

often their sexual partners and children as well. HIV/AIDS is responsible for orphaning over 15 million children worldwide, and ninety percent of the 2 million children currently living with the virus reside in sub-Saharan Africa (Foundation for AIDS Research, 2009). In Tanzania in 2007, HIV/AIDS caused nine percent of all deaths of children less than 5 years of age (World Health Organization, 2010). No cure is available for HIV. Therefore, prevention efforts are vital in mitigating further spread of the virus. As such, understanding the determinants of the epidemic's proliferation in this region of the world is important to effectively design and target initiatives aimed at its elimination.

HIV is transmitted when an individual comes into contact with infected bodily fluids, including blood, semen, vaginal fluids, and breast milk. Globally, the most common modes of transmission for HIV are sexual intercourse (both heterosexual and homosexual); intravenous drug use; blood transfusions; and mother-to-child transmission (during pregnancy, childbirth, or breast-feeding). Most cases (80%) in sub-Saharan Africa can be attributed to heterosexual transmission (United Republic of Tanzania, 2014). Syphilis and HSV-2 are spread in this manner as well. Sexual contact is therefore one of the most important target areas for prevention of all STIs, including HIV.

Important risk factors for transmission of HIV/STIs include alcohol use (Ghebremichael, Paintsil, & Larsen, 2009; Wilson et al., 2014), transactional sex (Norris, Kitali, & Worby, 2009; Raj et al., 2011), high number of sexual partners (Carpenter et al., 2002; Grgic-Vitek, Svab, & Klavs, 2006; Street, Morar, Wand, & Ramjee, 2014), failure to use a condom in high-risk sexual encounters (Hinman, 1976; Holmes, Levine, & Weaver, 2004), and the practice of having concurrent sexual partners (Morris & Kretzschmar, 1997; Halperin & Epstein, 2004). This study

aims to explore social factors that may play an important role in decreasing sexual risk behaviors and STI acquisition.

Social capital, a concept developed through sociological study, has been examined as a possible target area for improving sexual health (Campbell, Williams, & Gilgen, 2002; Campbell, 2003; Crosby, Holtgrave, DiClemente, Wingood, & Gayle, 2003; Oman, Vesely, Aspy, McLeroy, & Luby, 2004; Taylor et al., 2007; Osborne, Baum, & Ziersch, 2009; Agardh, Emmelin, Muriisa, & Östergren, 2010; Gregson et al., 2011). The term social capital, now used in a multitude of sociological literature, was popularized largely by political scientist Robert Putnam in his nonfiction book *Bowling Alone* (2000) wherein Putnam discusses the "decline of social capital" in America. While Putnam emphasizes civic participation in his definition of social capital, the concept has been defined in a multitude of different manners by various sociologists (Kim, Subramanian, & Kawachi, 2008). In general, social capital is "a characteristic of social structures consisting of a network of cooperative relationships between residents of particular neighborhoods and communities that are reflected in the levels of interpersonal trust and norms of reciprocity and mutual aid" (Cockerham, 2007:167). Social capital describes the ways in which individuals are connected to resources and people who may influence their behaviors. Possessing social capital also provides individuals and communities with methods of coping with stressors. While a uniform definition or metric to examine social capital in populations accepted by all researchers does not currently exist, it is generally agreed upon that this complex variable operates on several different conceptual levels of analysis: individual, group, and neighborhood/community.

Social capital may have many applications related to prevention of diseases and health-behavior interventions. Many studies have been conducted aiming to delineate specific

mechanisms by which social capital can affect a person's health. Some studies show a positive association between social capital and health, while others show a negative relationship. In the positive direction, it has been postulated that social capital may promote positive lifestyle choices and deter risky health behaviors in people who are actively embedded in supportive relationships within their social environment (Turner 2003, 2004). Social capital connects people with health resources and knowledge on which to base health behaviors (Veenstra et al., 2005). This form of capital can improve the general health status of a population by promoting high levels of interpersonal trust and norms of reciprocity, and, in turn, shared benefits for all (Cockerham, 2007).

Some studies dealing specifically with social capital and sexual health reflect these reported positive associations. They found that higher levels of social capital decreased odds of risky sexual behaviors, such as failure to use condom during high-risk sexual intercourse (Crosby et al., 2003; Oman et al., 2004; Taylor et al., 2007; Agardh et al., 2010), along with decreasing odds for infection with STIs (Gregson et al., 2011). These studies illustrate that social capital may be a promising mechanism for explaining and eventually eliminating health disparities in sexual health.

However, additional studies dealing with social capital and sexual health have found just the opposite of these aforementioned studies (Campbell, 2003). Campbell et al. (2002), for example, found that when measured primarily as "membership in community groups", social capital had a variable effect on sexual health risk behaviors including alcohol use, non-use of condom, and "casual sex" encounters, as well as on HIV infection. They found that while membership in certain groups (i.e. religious organizations and sports clubs) reduced the odds of risky sexual behaviors, membership in other groups – primarily in "stokvels", voluntary savings

clubs whose meetings were usually accompanied by alcohol consumption and gambling – increased odds of the same risky sexual behaviors. Involvement in community groups has also been shown to negatively affect mental health, especially in women (Osborne et al., 2009).

This study attempts to add to the scant literature on conceptualizations and applications of the concept of social capital in developing countries. Story (2013) reports that, as of two years ago, only fourteen studies had been conducted in order to examine the relationship between social capital and health within the United Nation's list of least developed countries (LDCs). Of these fourteen studies, six investigated the topic of social capital and sexual health, using varied measures of both sexual health and of social capital, with mixed results (Djamba, 1997; Djamba, 2003; Paek, Lee, Simon, & Witte, 2008; Erulkar & Ferede, 2009; Agardh et al., 2010; Frumence et al., 2010; Larsen, 2010; Frumence, Erikkson, Nyström, Killewo, & Emmelin, 2011).

Relying primarily on a conception of social capital that emphasizes its social trust, reciprocity, and connectedness dimensions, we aim to examine the relationship between this factor and sexual health and associated risk behaviors. We hypothesize that individuals who possess high levels of social capital – as measured by factors such as high levels of trust in their neighbors, people to depend upon, and people from whom to get advice – in a Tanzanian sugar plantation community will report lower prevalence of having concurrent sexual partnerships and a lower prevalence of HIV/STI (syphilis and HSV-2).

METHODS

We analyzed data from a cross-sectional study of 623 agricultural plantation residents in the Tanganyika Planting Company (TPC) community located 32 kilometers from Moshi, Tanzania. TPC Ethical Committee, Tanzanian National Institute of Medical Research, Tanzanian

Commission on Science and Technology, and Yale University's Human Investigations Committee all gave ethical approval for the study.

Data Collection

We collected quantitative and clinical data from a recruited sample and from a voluntary sample of TPC residents. Camp-wide meetings were held to introduce the research team and describe the study's objectives to the community members. Eligible study participants were those individuals who had been TPC residents for at least two weeks prior to taking the survey, were at least eighteen years of age or married, and had the ability to give written consent.[1] TPC maintains ten separate residential camps in which their employees, both seasonal and permanent, and their dependents (of permanent employees only) reside. We randomly sampled four camps from these ten total camps. Forty percent of households from these four selected camps were then randomly selected from an enumerated list of all households. One individual from each selected household was then randomly selected.

As a result of the camp-wide meetings, many additional sampled residents expressed a desire to participate in the study. These non-randomly sampled participants were allowed to participate as long as they met the aforementioned criteria for eligibility, and they constitute the group of 'voluntary participants'. One kilogram of rice was used as an incentive for survey participation.

Instrument

Study participants completed a self-administered Swahili language questionnaire using audio computer-assisted self-interviews (ACASI). The software not only displayed the text of each question on the computer screen, but also read the question aloud to participants. Participants used a touch screen to select their response. Most participants were easily able to

[1] Six original survey participants were under 18 years of age and were eliminated before any analysis was performed for the current study. These 6 participants were spouses or "main partners" of other participants.

navigate and use the ACASI system and were able to answer questions on their own, despite previous unfamiliarity with computers. Those who could not use the ACASI system had research assistants enter their responses. Survey questions were designed with specific knowledge of the TPC agricultural plantation context, including demographic questions and questions pertaining to the prevalence/frequency of specific sexual behaviors and alcohol and drug use. Participants also completed questions relating to various aspects of their perceived social capital, including trust amongst neighbors and participation in decision making processes within their camp of residence.

Clinical Data

After completing the survey, participants received, free of charge, STI testing for HSV-2, syphilis, and HIV along with a private meeting with a trained counselor to learn about these infections, methods of self-care and preventing their transmission, and, in the case of positive diagnoses, referrals for medical and social services available.

Individuals scheduled follow-up visits within two weeks of the cross-sectional survey to receive HSV-2 and syphilis results and, if indicated, treatments. Participants found to be infected with these infections were encouraged to bring their partner for treatment as well.

Variables

Alcohol use. In order to measure and use alcohol use as an exposure variable in our final multivariate models, we used one item from the original questionnaire. Participants answered the question “In the past 30 days, how often have you drank alcohol?”. Answer options were: never, very few times, once per week, more than once per week, or every day.

Number of lifetime partners. As a part of the original questionnaire used for data collection, participants answered the question: “[C]an you tell me how many men you have had

sex with in your life?", including their current partner and any forced sexual interactions. The question also included a statement asking them to estimate their number of lifetime partners if they were unsure of the exact number. For the purposes of our analysis, this variable was recoded as "none", "one", "two", "three", or "four or more" lifetime partners. Participants who were not yet sexually active – defined as those who chose "not applicable" or "zero partners" in response to this question – were excluded from the analysis.

Transactional sex. The original questionnaire included six questions relating to transactional sex practices. Participants were asked (yes/no) whether they had ever exchanged sex for: money, gifts, food, alcohol, or anything else (including employment). We used these measures to construct a variable with three categories: participants who had never participated in transactional sex, those who had participated in one type of exchange, and those who had participated in more than one type of exchange.

Social capital. Participants answered seven questions pertaining to their perceived social capital within the context of their camp of residency. These questions – adapted from an Adolescent Health Survey administered in San Francisco (Dunbar & Kang et al., 2004) based on knowledge about commonly considered aspects of social capital – were yes/no questions asking participants whether they have people from whom to get help and/or advice, close and safe friendships, people who depend on them, people who share their interests, whether they participate in decision-making processes in their camp, and whether they trust their neighbors.

Concurrent sexual partners. In order to measure this particular risky sexual behavior used as one of the main outcomes of interest in this study, participants answered the question "During the time of your relationship with your main partner, how many other people have you

had sex with?"[2] Answer options to this question were: 0, 1, 2, 3, or 4 or more concurrent partners. This variable was then recoded as dichotomous: no concurrent partners vs. at least one concurrent partner.

STI prevalence. All STI testing was done on-site. Rapid tests Determine (Abbott Laboratories, Diagnostics Division, Abbott Park, IL) and Capillus (Trinity Biotech USA, Jamestown, NY) were used for HIV testing. If both antibody tests came back negative, patients were deemed seronegative for HIV. They were considered seropositive if both antibody tests came back positive. Indeterminate tests were resolved using Western blot (Bio-Rad Laboratories LTD., Dartford, UK). HSV-2 was diagnosed with HerpeSelect 2 ELISA IgG test (Focus Technologies, Cypress, CA). Remel's rapid plasma regain (RPR) Card Test (Remel, Lenexa, KS) was used to test serum for syphilis. A Murex TPHA (treponema palladium hemagglutination assay) test (Abbot Murex Biotech Limited, Darford, UK) was used to confirm syphilis diagnosis in RPR-reactive specimens. RPR- and TPHA-positive tests indicated active or recent syphilis in participants.

Due to a low overall prevalence of HIV and syphilis (7% and 9%, respectively) in our study population, combined with a high overall prevalence of HSV-2 (59%), the STI outcome was dichotomized: diagnosis of *any* of these STIs versus no STI diagnosis.

Data Analysis

In order to collapse the seven measures of social capital used in our questionnaire into fewer factors, we used principal component analysis (PCA). PCA takes a number of partially correlated factors and reduces them into fewer, uncorrelated factors. These uncorrelated end factors, called "components", can then be used as composite variables that serve as predictors in

[2] If participants did not have a main partner at the time of the study they answered "Not applicable". Those who answered in this way, along with those who answered "I don't know" or "I don't wish to answer" on this item were excluded from our analysis

regression models. This analysis was done in order to decrease the risk for both type I errors (by reducing the number of statistical tests performed) and type II errors. Creating a summary risk factor attempts to produce stronger and more precise measures of association in the event a true association with the dependent variable exists (Joliffe & Morgan, 1992; Posner, Pulley, Artz, & Macaluso, 2003).

We used the principal axis method to extract components and the varimax rotation method to produce uncorrelated components. We determined the number of components to retain by considering the number of factors with eigenvalues greater than 1 and identifying where the break occurred in the scree plot. Variables with a "loading score" of 0.40 or higher on one component and a loading score of less than 0.40 on all other components – that is, no "cross-loading" – were included within that given component.

In the process of using PCA to construct several uncorrelated dimensions by which to measure social capital, "participation in decision making" cross-loaded, meaning that after varimax rotation, this item had a primary factor loading of >0.4 for two separate components. The final principal component model included six separate items, resulting in the retention of two final components that together explained 53% of the variance among these factors. The final factor loading matrix for this analysis can be seen in Table 1. The communality values shown are the percentages of variance accounted for by the given variable. We were then able to use each of these components separately as regressors against our outcomes of interest in our final multivariate models along with age, education, decision-making, and common risk factors.

Table 1. Factor loadings and communalities from a principal component analysis for 6 items measuring social capital

	Component 1 (Reciprocity)	Component 2 (Network)	Communality
If participant trusted neighbors in camp	0.54*	0.09	0.30
If participant had person at TPC from whom to get advice	0.82*	0.13	0.70
If participant had person at TPC from whom to get help	0.79*	0.15	0.65
If participant had people at TPC who depend on them	0.03	0.66*	0.43
If participant had close and safe friendships at TPC	0.20	0.71*	0.54
If participant had people at TPC who share their interests	0.17	0.71*	0.53

We performed chi-squared tests to identify differences by gender in other demographic variables and in variables measuring alcohol/drug use, social capital, sexual behaviors, and STI prevalence. Several significant differences were found between men and women in our sample, leading us to stratify our final analyses by gender. Identical final models were used for both males and females for ease of interpretability and comparability. Using logistic regression models, we examined associations between social capital and the prevalence of having concurrent sexual partners. We also utilized this multivariate model to examine the associations between social capital and infection with "any STI" (syphilis, HSV-2, and HIV). In both models, we adjusted for age and education, along with several sexual health risk behaviors (based on previous studies): alcohol use, transactional sex, and number of lifetime sexual partners.

All statistical analysis was performed using JMP, version 11.0.0.

RESULTS

Demographics

A total of 623 participants participated in the computer-based survey. We excluded from the analysis participants who were under 18 years of age and those who had not yet experienced sexual debut at the time of data collection. Of the remaining 460 respondents, 49% were male and 51% were female (Table 2). Most respondents (34.9%) were between 34 and 45 years old. Most members of our sample stated religion was either "somewhat important" or "very important" to them (94.7%). Most people in our sample attended school through primary, and men were statistically significantly more likely to have more education than women (data not shown, p-value = 0.01).

Table 2. Sociodemographic characteristics of respondents

	Total (n= 463) No. (%)	Male (n=227) No. (%)	Female (n=236) No. (%)
Age			
18-25 years	109 (24.4)	61 (27.9)	48 (21.1)
26-33 years	141 (31.5)	50 (22.8)	91 (39.9)
34-45 years	156 (34.9)	81 (37.0)	75 (32.9)
46+ years	41 (9.1)	27 (12.3)	14 (6.1)
Importance of religion			
Not or somewhat important	24 (5.3)	13 (5.9)	11 (4.8)
Very important	426 (94.7)	206 (94.1)	220 (95.2)
Highest level of education			
None	49 (11.0)	18 (8.2)	31 (13.7)
Some primary	318 (71.3)	152 (69.4)	166 (71.1)
Secondary or more	79 (17.7)	49 (22.4)	30 (13.2)

Risk Behaviors and STI Prevalence

Nearly half (47.5%) of participants reported engaging in at least one type of transactional sex exchange, including over half of male participants and over one-third of female participants (Table 3). Most people (56.1%) had not consumed any alcohol during the past 30 days. Drug use in this population was low: only 5.4% of participants reported any use of any type of drug within the past 30 days. Just under half (48.6%) of participants reported having had only 1-2 sexual partners over the course of their lifetime. Men were significantly more likely to have a higher number of sexual partners than women (p-value = <0.01). 10.6% of men and only 1.6% of women reported having had over 15 sexual partners over the course of their lifetime. Seventeen percent of participants reported having had a concurrent sexual partner during the time of their current "main" sexual relationship. Men were significantly more likely to have had at least one concurrent sexual partner (p-value = <0.01). Twenty three percent of male participants reported having had a concurrent partner, while only 11.3% of women who reported having had one.

The prevalence of HIV was 7.4%, overall: 8.2% and 6.4% for men and women, respectively. The prevalence of syphilis was 9.3% and was similar in both men and women (9.1% and 9.5%, respectively). A large proportion (58.5%) of the population was found to be infected with HSV-2. This prevalence was due largely to the high prevalence rate for HSV-2 infection among women in our sample. Women were significantly more likely than men to be infected with HSV-2 (68.2% and 48.7%, respectively, p-value = < 0.01). Women were also therefore significantly more likely to be infected with at least one of these STIs (70.2% prevalence of "any STI" in females vs. 49.0% prevalence in males, p-value = <0.01), because of the disproportionate burden of HSV-2 infection by gender.

Table 3. Behavioral characteristics and STI status of respondents (N = 460)

	Total (n= 463) No. (%)	Male (n=227) No. (%)	Female (n=236) No. (%)
Transactional sex			
Never	240 (52.5)	94 (41.6)	146 (63.2)
One exchange	86 (18.8)	41 (18.1)	45 (19.5)
More than one exchange	131 (28.7)	91 (40.3)	40 (17.3)
Alcohol use in past 30 days			
None	247 (56.1)	120 (55.6)	127 (56.7)
Very few times	67 (15.2)	29 (13.4)	38 (17.0)
Once per week	21 (4.8)	10 (4.6)	11 (4.9)
More than once per week	33 (7.5)	14 (6.5)	19 (8.5)
Every day	72 (16.4)	43 (19.9)	29 (13.0)
Lifetime sexual partners			
1 – 2	225 (48.6)	73 (32.2)	152 (64.4)
3 – 4	106 (22.9)	52 (22.9)	54 (22.9)
5 – 7	62 (13.4)	43 (18.9)	19 (8.1)
8 – 14	42 (9.1)	35 (15.4)	7 (3.0)
15+	28 (6.1)	24 (10.6)	4 (1.6)
Concurrent partners			
No	377 (83.04)	172 (77.1)	205 (88.7)
Yes	77 (17.0)	51 (22.9)	26 (11.3)
HIV test results			
Negative	353 (92.7)	178 (91.8)	175 (93.6)
Positive	28 (7.4)	16 (8.2)	12 (6.4)
Syphilis test results			
Negative	340 (90.7)	169 (90.9)	171 (90.5)
Positive	35 (9.3)	17 (9.1)	18 (9.5)
HSV-2 test results			
Negative	157 (41.5)	97 (51.3)	60 (31.8)
Positive	221 (58.5)	92 (48.7)	129 (68.2)
Infection with any STI (syphilis, HIV, HSV2)			
No	158 (40.6)	101 (51.0)	57 (29.8)
Yes	231 (59.4)	97 (49.0)	134 (70.2)

Social Capital

Table 4 illustrates results from the separate social capital items from the questionnaire before PCA was performed. Men were significantly more likely than women to: 1) have people at TPC from whom they could get help (p-value = 0.0017), 2) have safe and close friendships at TPC (p-value = 0.0002); and 3) have people at TPC who share their interests (p-value = 0.0009).

Table 4 Measures of social capital (N = 460)

	Total (n= 463) No. (%)	Male (n=227) No. (%)	Female (n=236) No. (%)
Trust in neighbors			
No	204 (47.1)	101 (47.9)	103 (46.4)
Yes	229 (52.9)	110 (52.1)	119 (53.6)
People from whom to get advice			
No	112 (25.6)	53 (24.8)	59 (26.3)
Yes	326 (74.4)	161 (75.2)	165 (73.7)
People from whom to get help			
No	122 (27.9)	45 (21.0)	77 (34.5)
Yes	315 (72.1)	169 (79.0)	146 (65.5)
People who depend on you			
No	226 (52.8)	108 (51.7)	118 (53.9)
Yes	202 (47.2)	101 (48.3)	101 (46.1)
Close and safe friendships			
No	116 (26.3)	40 (18.4)	76 (34.1)
Yes	325 (73.7)	178 (81.7)	147 (65.9)
Shared Interests			
No	94 (22.9)	33 (16.0)	61 (29.8)
Yes	317 (77.1)	173 (84.0)	144 (70.2)
Participate in decision making in camp			
No	223 (52.5)	101 (47.9)	122 (57.0)
Yes	202 (47.5)	110 (52.1)	92 (43.0)

Associations between Predictors and Concurrent Partnerships

We stratified our final multivariate analyses by gender because of several significant differences between men and women found during bivariate analysis of risk behaviors and exposures by sex (age, education, transactional sex, lifetime number of sexual partners, people from whom to get help, people with shared interests, participation in decision-making, and close and safe friendships).

Our multivariate results show that, for men, none of the three social capital dimensions – reciprocity, network, and decision-making – were significantly associated with having concurrent sexual partnerships, although two of these dimensions had a non-significant protective association: network (AOR=0.89, 95% CI 0.57-1.38) and decision-making (AOR=0.45, 95% CI 0.19-1.02) (Table 5a). Reciprocity appears to increase odds for concurrency (AOR=1.22, 95% CI 0.92-1.67 for men; AOR=1.44, 95% CI 0.87-2.61 for women), although these findings were not statistically significant.

In women, having a close social network was significantly associated with decreased odds for having concurrent partners (AOR=0.47, 95% CI 0.23-0.87) (Table 5a). Most "traditional" risk factors included in our analysis (alcohol use, transactional sex, number of lifetime partners), were not statistically significantly associated with concurrent partnerships. Among women, transactional sex was significantly associated with having concurrent sexual partners (AOR=2.25, 95% CI 1.08-4.87).

Our results indicate that men who participate in local decision making were more likely to be infected with any STI (AOR=2.34 95% CI 1.04-5.45). Alcohol use (AOR=1.73, 95% CI 1.31-2.38) was also significantly associated with increased odds of an infection in men. The other two dimensions of social capital – network and reciprocity – were not significantly

associated with STIs in men (AOR=1.16, 95% CI 0.79-1.72 and AOR=1.19, 95% CI 0.89-1.59, respectively).

Participation in transactional sex (AOR=2.97, 95% CI 1.25-7.58) significantly increased odds of infection with any STI in women. As with the outcome of concurrent sexual partnerships, network and decision-making could be protective against prevalent STI in women (AOR=0.76, 95% CI 0.49-1.15 and AOR=0.58, 95% CI 0.23-1.42), while reciprocity could increase these odds (AOR=1.37, 95% CI 0.95-1.72), though none of these relationships achieved statistical significance.

Table 5a. Multiple regression analysis of participant characteristics (selected demographic information, risk behaviors, and social capital) and concurrent sexual partnerships, by gender

	Unadjusted OR (95% CI)		Adjusted OR (95% CI)	
	Men (n=181)	Women (n=174)	Men	Women
Demographic				
Age	1.19 (0.87, 1.65)	0.75 (0.45, 1.22)	1.35 (0.91, 2.04)	0.71 (0.32, 1.54)
Education	1.02 (0.566, 1.87)	0.63 (0.28, 1.40)	1.30 (0.73, 2.33)	0.84 (0.19, 3.75)
Social capital				
Reciprocity	1.13 (0.89, 1.46)	1.25 (0.90, 1.80)	1.22 (0.92, 1.67)	1.44 (0.87, 2.61)
Network	1.06 (0.76, 1.49)	0.69 (0.43, 1.09)	0.89 (0.57, 1.38)	0.47 (0.23, 0.87)*
Decision-making	0.58 (0.30, 1.12)	0.75 (0.29, 1.85)	0.45 (0.19, 1.02)	0.48 (0.12, 1.79)
Risk factors				
Transactional sex	1.48 (1.04, 2.13)*	2.41 (1.47, 3.99)*	1.07 (0.65, 1.74)	2.97 (1.25, 7.58)*
Lifetime partners	1.54 (1.22, 1.96)*	2.00 (1.38, 2.93)*	1.12 (0.99, 1.26)	1.10 (0.77, 1.51)
Alcohol use	1.26 (1.04, 1.52)*	1.38 (1.06, 1.79)*	1.12 (0.88, 1.41)	1.25 (0.82, 1.91)

(* = statistically significant for $\alpha = 0.05$)

Table 5b. Multiple regression analysis of participant characteristics (selected demographic information, risk behaviors, and social capital) and any STI, by gender
(N_{men} = 163, N_{women} = 149)

	Unadjusted OR (95% CI)		Adjusted OR (95% CI)	
	Men (n=163)	Women (n=149)	Men	Women
Demographic				
Age	1.61 (1.20, 2.18)*	2.27 (1.51, 3.50)*	1.46 (1.00, 2.15)	2.57 (1.49, 4.72)*
Education	0.57 (0.32, 0.99)*	0.70 (0.36, 1.33)	0.64 (0.33, 1.20)	0.60 (0.22, 1.53)
Social capital				
Reciprocity	1.16 (0.93, 1.45)	1.02 (0.81, 1.28)	1.19 (0.89, 1.59)	1.37 (0.95, 1.72)
Network	1.25 (0.93, 1.72)	0.85 (0.61, 1.18)	1.16 (0.79, 1.72)	0.76 (0.49, 1.15)
Decision-making	1.88 (1.05, 3.39)*	1.17 (0.60, 2.30)	2.34 (1.04, 5.45)*	0.58 (0.23, 1.42)
Risk factors				
Transactional sex	1.35 (0.99, 1.86)	1.96 (1.25, 3.21)*	1.38 (0.86, 2.24)	2.53 (1.24, 5.56)*
Lifetime partners	1.19 (0.97, 1.47)	2.14 (1.36, 3.74)*	1.00 (0.89, 1.14)	1.23 (0.96, 1.69)
Alcohol use	1.45 (1.20, 1.78)*	1.20 (0.95, 1.54)	1.73 (1.31, 2.38)*	1.03 (0.73, 1.49)

(* = statistically significant for $\alpha = 0.05$)

DISCUSSION

Our results do not entirely support our initial hypothesis that individuals with more social capital would experience lower odds of reporting concurrent sexual partnerships and less prevalent STIs. Some measures of social capital were associated with *increased* odds of STI infection. Women with a network of friends, people to depend on, and people who share their interests (the "network" component constructed via PCA) were less likely to participate in the risky sexual practice of having concurrent partners. However, men who participated in community decision making were more likely to have a prevalent STI. These findings illustrate how complicated and nuanced is the concept of social capital. The commonly known risk factors included in our analysis – alcohol use, number of lifetime sexual partners, and transactional sex practices – appeared to increase odds for STI infection and for concurrent partnerships, as expected. Drug use was not included in our final analyses due to very low rates of drug use in the study population, although it has been found to be significantly associated with prevalent STI and other risk behaviors (Kwong-Lai Poon, Pui-Hing Wong, Sutdhibhasilp, Trung-Thu Ho, & Wong, 2012; Yao et al., 2012; Regan, Dyer, Gooding, & Morisky, 2013). Transactional sex was the only risk behavior significantly associated with each outcome (although only significant for women), indicating a potential area for targeting interventions and prevention methods.

One reason that some dimensions of social capital may have served as a risk factor in this study instead of a protective factor as originally predicted is that not all social capital is equal. Whether the social capital to which an individual has access influences them to engage in more risk behaviors or fewer risk behaviors is highly dependent on the social norms and the types of opportunities for involvement within a given community. Campbell (2003) discusses this potential for negative or neutral effects of social capital on health as a phenomenon of "anti-

social capital." Just because an individual has a strong social network, feels a sense of reciprocity with their neighbors, has people to get advice from, etc. does not mean that the advice will be sound or that their network will influence them to partake only in healthy behaviors or subscribe to beliefs that positively impact their health. A study done by Gregson, Terceira, Mushati, Nyamukapa, & Campbell (2004) supports this idea. They found that while membership in community groups was an overall protective factor against HIV in women, these findings varied based on the type of group and how well the specific group functioned. These results support ours in suggesting the importance of contextualizing social capital and using caution when applying the concept broadly in attempts to label it as wholly positive or wholly negative. In addition to these potential complications, it is possible that interactions between social capital and sexual health could be bidirectional: a person's health could influence how much social capital they possess. Larsen (2010) found, for example, that participating in the practice of labia elongation actually increased women's social capital within their community.

Our results show some aspects of social capital that may be promising areas for targeting interventions and prevention efforts combatting STI transmission, especially the dimension we have named "network" which includes the existence of safe/close friendships, people to depend on, and people with shared interests. The fact that this dimension was associated, for women, with decreased odds of having concurrent sexual partnerships in our study population could indicate that having a network of this kind can reinforce healthy social norms that discourage risky sexual behaviors. Frumence et al. (2011) found that the solidarity created from participation in community groups in another area of Tanzania was a powerful influence on reducing the prevalence of risk behaviors related to HIV transmission. They also concluded that this form of social capital can connect people to resources for the treatment of HIV and places to

learn about HIV prevention methods. Social capital has been found to be associated with decreased likelihood of participation in other sexual health risk factors as well including failure to use a condom with new sexual partners, high number of lifetime partners, and early/unwanted sexual debut (Erulkar & Ferede, 2009; Agardh et al., 2010).

For men, the fact that participation in decision making in their camps of residence increased odds for prevalent STI could have broader implications relating to the overall power structures and gender dynamics within this community. Men who participate in decision-making may be in positions of relative power within their community. This elevated social status may make them desirable mates to females in the community, potentially resulting in more sexual partners overall. Men who participate in local government in this way may also use sexual relationships to expand and assert their power in other ways outside of civic participation. Studies have been conducted relating to the representation or, more commonly, the underrepresentation of women in local governments around the world (Moore, 1993; McGregor & Clover, 2011; Vazquez-Garcia, 2012) and on the effect that power differentials based on gender may have on rates of STIs (Kaufman, Shefer, Crawford, Simbayi, & Kalichman, 2008; Rosenthal & Levy, 2010; Weine et al., 2013), but we could not find any research that synthesized these ideas together. Further research should investigate the potential connections between involvement in community decision making, power within sexual relationships, sexual health, and risk behaviors.

This study is subject to several limitations. We are not able to make claims about the temporality of risk behaviors and outcomes because data were collected via a cross-sectional study design. While we hypothesized that social capital would influence a person's sexual health, the relationship could conceivably operate in the opposite direction: participating in risky sexual

behaviors or having an STI could negatively affect an individuals' social capital due to stigma within a community. Therefore, we cannot draw conclusions about causality from these results. As with any study utilizing questionnaires, our data was subject to potential response bias and issues with accurate recall of information when necessary, such as the amount of alcohol consumption over the past 30 days. Respondents who did not have a main partner were excluded from analysis, introducing a potential bias relating to the outcome of concurrent partnerships. These eliminated individuals could engage in risky sexual behaviors, but because they didn't have one "main" partner their responses were not included in the final models for analysis. Another limitation to this study was introduced when performing PCA. As reported above, the final components that were extracted from the PCA only explained about half of the variance among the original set of variables included in the analysis. A higher proportion of variance explained by these derived principal components would yield results of higher validity.

A final, related limitation can be found in the way we chose to define social capital and the ways in which we were able to measure this factor as our primary independent variable. Social capital has been defined and measured in a variety of ways, and these specific definitions and metrics used must be taken in consideration when comparing and generalizing results from one study to another. Our definition, for example, relies more heavily on interpersonal factors like trust and the existence of a social network and less heavily on membership within community groups – the original questionnaire did not include many questions pertaining to this particular area of interest, a popular indicator used to measure social capital in similar studies.

More research is necessary in order to develop a uniform definition and measure of social capital and/or its separate dimensions, so the term may be consistently applied and understood. We suggest that longitudinal studies would be beneficial in regards to this topic in beginning to

establish temporality and the specific mechanisms by which social capital may affect health. Future studies should especially focus on continuing to develop a definition of social capital that can be applied within the context of developing countries. These expanded and validated definitions of social capital could then be used in further studies aiming to delineate the complicated and multifaceted relationship between social capital and sexual health.

CONCLUSIONS

Based on our results, we suggest that the formation of community groups that encourage unity and friendships between women in a given community could have an impact on reducing the prevalence of risky sexual behaviors and subsequent incidence rates of STIs in these communities. To reduce rates of STI prevalence in men, we suggest further examination of the social implications of participating in local governance and the role that gendered conceptions of power may have on sexual behavior and infection rates. Research in the area of gender and power relations, social capital, and sexual health are vital in order to understand the ways that social capital operates differently depending on a person's gender. Knowledge in this particular area would help in the formation of gender-specific programs targeted at reducing STI rates.

Our inconclusive results about the other dimensions of social capital imply that – until further research is conducted in order to form a uniform definition of social capital and delineate the relationship between social trust and reciprocity within a community and STI rates – targeting traditional risk factors, such as alcohol use, will have broader public health impacts and will be more successful in reducing the global burden of disease caused by HIV/STIs. A notable potential target area for prevention and intervention efforts in STIs and associated risk behaviors is the practice of transactional sex, as this variable was the only predictor to be significantly

associated with both outcomes (in women only; transactional sex was not significantly associated with either outcome for men). Transactional sex is seen in this community as an inevitable consequence of a lack of economic opportunities and employment for women (Norris, Kitali, & Worby, 2009). The creation of other opportunities for socioeconomic advancement and sustaining a livelihood for women especially may therefore reduce rates of transactional sex and, subsequently, reduce rates of STI and other risk behaviors. Transactional sex is not commonly stigmatized in Africa, where it is seen as an often necessary method of gaining income (Dunkle et al., 2004; Maganja, 2007; Wamoyi, Fenwick, Urassa, Zaba, & Stones, 2011; Stephenson, Winter, & Elfstrom, 2013). As such, educational programs aimed at emphasizing the risks associated with this behavior and their severity could also aid in reducing STI rates.

Limitations and areas for potential further research notwithstanding, this study contributes to the current body of knowledge on associations between social capital and health by examining social capital in terms of its separate dimensions and the ways in which these dimensions may be related to STI prevalence and an important sexual health risk behavior. We have suggested several pathways by which social capital may affect individuals' health, both positively and negatively, and have identified important areas for future studies to continue to advance our knowledge in this particular field of study.

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